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JURNAL INFOKUM, Volume 9, No.2, Juni 2021 ISSN : 2302-9706

ANALYSIS ALGORITHM APRIORI IN MEDICAL DEVICE SUPPLY PLANNING

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Article Info
Received 01 June 2021
Revised 20 June 2021
Accepted 30 June 2021

The application of the Apriori Algorithm helps in forming possible candidate item combinations, then testing whether the combination meets the minimum support and confidence parameters which are the threshold values given by the user. Even though until now, service activities and transactions at pharmacies have not experienced any significant problems, of course this situation will one day become an inhibiting factor in improving service as more and more transactions and types of items and transaction items are stored within a certain period of time, making it difficult for the pharmacy. in analyzing the types of items and itemset which consumers are most interested in or not interested in so that they can control the inventory of medical devices. The results of the study: The results of the pattern analysis above show that the greater value of support from a combination of medical devices provides recommendations for the medical devices most often purchased by consumers are thermometers, gauze, plaster, and elastic bandages. Conversely, the smaller the value of support for a combination of medical devices means that recommendations are given based on medical devices that are rarely purchased. The results of the application of the a priori method with a minimum support of 30% with a combination of 3 and 4 itemsets are if the thermometer, gauze, plaster, elastic bandages. The priori method used is quite effective in providing the final drug combination that is often purchased by consumers. The level of accuracy of the test using the a priori method is 100%.

Keywords: Data Mining, Apriori

1. Introduction

The current development of information technology makes information an important element in the presentation of information, which is not commensurate with the high information needs [1].

To get medical equipment that suits your needs, meets standards and is optimal in utilization, it is necessary to have good medical device logistics management. Management logistics is a strategic management process for moving and storing goods, spare parts and finished goods from suppliers, between company capacities and to traders. 3 Meanwhile, logistics management in a hospital is defined as a processing process strategically on procurement, storage, distribution, monitoring of material inventory (stock, materials, supplies, inventory and others) [2].

Presentation of information is not commensurate with the very high need for information, so that information needs to be explored deeper than large amounts of data. Extracting information or patterns that are important or interesting from large amounts of data is used by decision makers in utilizing data warehouses. This mining process uses statistical techniques, mathematics, artificial intelligence, and machine learning to identify useful information and related knowledge from various large databases, also known as data mining [3]. One of the data mining methods is association rules by analyzing a sales transaction. Sales transaction analysis aims to design an effective sales or marketing strategy by utilizing sales transaction data that is already available in the company [1].

In the competition in the business world, especially the Pharmacy industry, it requires developers to find an accurate strategy that can increase sales of goods. One way to overcome this problem is to keep the availability of various types of medical equipment continuously in the pharmacy warehouse. To find out what medical devices are purchased by consumers, market basket analysis

2. Research Background

Research according to [6]. entitled Implementation of Data Mining on Airplane Ticket Sales Using the Apriori Algorithm. Explaining that Data Mining is a very useful technology to help companies find very important information from their data warehouse which has no known benefits. Robi Yanto, et al [5]. Implementation of Data Mining with the Apriori Algorithm Method in Determining Drug Purchase Patterns. Explained that the process of determining drug purchase patterns can be done by applying Data Mining. With the appriori algorithm method. With this method, the determination of purchasing patterns can be done by looking at the results of the consumer's tendency to buy drugs based on a combination of 2 itemset. The new knowledge that can be obtained is based on the calculation of the Apriori algorithm and the system that is built can be arranged in close proximity to the layout of drugs to facilitate drug availability.

3. Research Method

The Apriori algorithm is a basic algorithm proposed by Agrawal & Srikant in 1994 for the determination of frequent itemsets for boolean association rules. A priori algorithms are a type of association rule in data mining. A rule that states the association between attributes is often called an affinity analysis or market basket analysis. Association analysis or association rule mining is a data mining technique to find rules for a combination of items.

The basic methodology of association analysis is divided into two stages, namely [3].

1. High frequency pattern analysis This stage looks for a combination of items that meet the minimum requirements of the support value in the database. The support value of an item is obtained using the following formula:

   Support (A) =

$$\frac{\text{Jumlah Transaksi Mengandung A}}{\text{Total Transaksi}} \quad (1)$$

   Sedangkan nilai dari *support* dua *item* diperoleh dari rumus berikut :

   Support (A,B) = (A∩B)

$$\frac{\text{Jumlah Transaksi Mengandung A dan B}}{\text{Total Transaksi}} \quad (2)$$

2. Establishment of Association Rules

   After all high frequency patterns are found, then we look for associative rules that meet the minimum requirements for confidence by calculating the confidence of the association rule "if A then B". The confidence value of the rule "if A then B" is obtained from the following formula: Confidence = P (B | A) =

$$\frac{\text{Jumlah Transaksi Mengandung A dan B}}{\text{Jumlah Transaksi Mengandung A}} \quad (3)$$

4. Results and Analysis

The case example in this study uses the a priori algorithm in controlling medical devices for pharmacies. In order to process the medical device transaction data, it is necessary to describe the work stages that can be carried out on the a priori algorithm as shown in

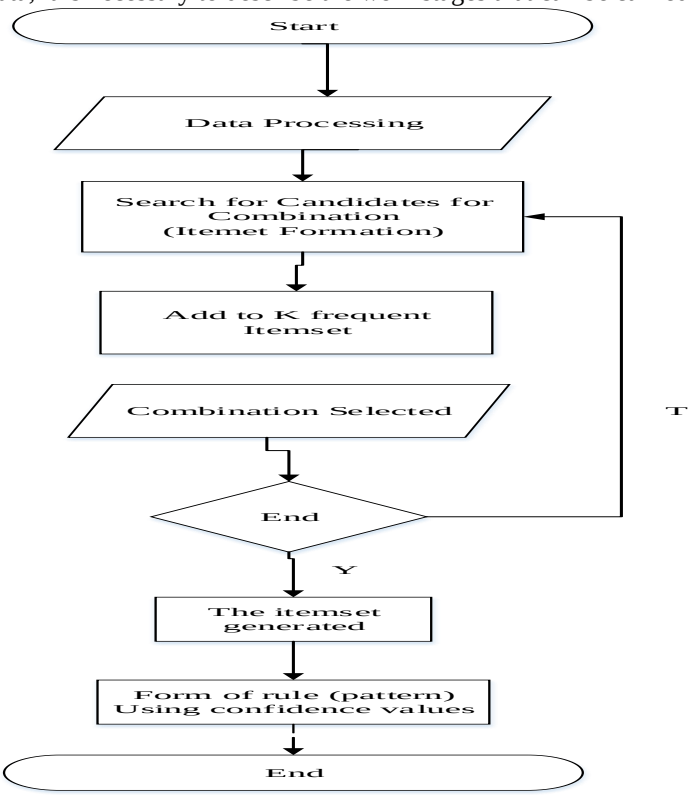

Fig 1 *Flowchart* Algorithm Apriori

The following is data on medical devices at the hospital pharmacy in life as shown in Table.1 below:

Table 1.
Medical Device Data

Medical Device Code	Nam of Devical Device
B001	Termometer
B002	Kain kasa
B003	Plaster
B004	Perban elastis
B005	Masker
B006	Sarung tangan
B007	Pompa susu
B008	Pelindung puting susu
B009	Botol susu
B010	Alat tes kehamilan
B011	Kantung darah
B012	Alat suntik
B013	Kompres dingin
B014	Tensimeter
B015	Penyangga leher

The following is the transaction data for the January 2019 period, where the accumulated sales of medical devices are carried out in Table .2.

Table 2. Sales Transaction

Transaksi	B001	B002	B003	B004	B005	B006	B007	B008	B009	B010	B011	B012	B013	B014	B015
T001	√				√	√									
T002		√					√	√							
T003	√	√						√						√	
T004					√			√							√
T005	√				√	√									
T006		√	√	√											
T007	√			√					√						√
T008		√			√								√		
T009		√						√							√
T010									√	√		√			
T011	√	√	√												
T012	√	√	√												
T013	√	√	√												
T014	√	√	√												
T015	√	√	√												
T016	√	√	√												
T017	√	√	√	√											
T018	√	√	√	√											
T019	√	√	√	√											
T020	√	√	√	√											
Jumlah	**14**	**16**	**11**	**6**	**5**	**2**	**1**	**3**	**2**	**1**		**1**	**1**	**1**	**3**

Based on transaction data in the January 2019 period, accumulated sales transactions were carried out, which was shown by medical device data in Table 3.

Table 3. Sales Transaksion

Transaksi	Item Alat Kesehatan
T001	B001, B006, B005
T002	B002, B007, B002, B008
T003	B001, B002, B008, B014
T004	B005, B008, B015
T005	B001, B005, B006
T006	B003, B004, B002
T007	B001, B015, B009, B004
T008	B002, B005, B0013
T009	B015, B002, B008
T010	B010, B009, B012
T011	B001, B002, B003
T012	B001, B002, B003
T013	B001, B002, B003
T014	B001, B002, B003
T015	B001, B002, B003
T016	B001, B002, B003
T017	B001, B002, B003, B004

T018	B001, B002, B003, B004
T019	B001, B002, B003, B004
T020	B001, B002, B003, B004

After the transformation is complete, then the next step is solving the case of making a combination of 3 set items so that they cannot be combined again and recording the number of occurrences of the combination in the data. The following shows the results of a combination of 3 items

Table 4. 3 Sale Item

Transaksi	Item Alat Kesehatan	Jumlah
T001	B001, B006, B005	2
T004	B005, B008, B015	1
T006	B003, B004, B002	1
T008	B002, B005, B0013	1
T009	B015, B002, B008	1
T010	B010, B009, B012	1
T011	B001, B002, B003	6

Furthermore, after the transformation is complete, the next step is to make a combination of 4 set items so that they cannot be combined again and record the number of occurrences of the combination in the data. The following shows the results of a combination of 4 items

Table 5.
4 Sale Item

Transaksi	Item Alat Kesehatan	Jumlah
T002	B002, B007, B002, B008	1
T003	B001, B002, B008, B014	1
T007	B001, B015, B009, B004	1
T017	B001, B002, B003, B004	4

The following is a settlement based on the data provided in Table III.4. and Table III.5. The process of forming C3 or what is called 3 and 4 itemset with a minimum amount of support = 30% with the following formula:

$$\text{Support } (A,B) = \frac{\sum \text{transaksi mengandung A, B, dan C}}{\sum \text{transaksi}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$\text{Confidence } (A,B) = \frac{\sum \text{transaksi mengandung A, B, dan C}}{\sum \text{transaksi A}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Table 6. 3 dan 4 Item Support

Data Transaksi	Support
Termometer	(14/20) x 100% = 70.00%
Kain kasa	(16/20) x 100% = 80.00%
Plaster	(11/20) x 100% = 55.00%
Perban elastis	(6/20) x 100% = 30.00%
Masker	(5/20) x 100% = 25.00%
Sarung tangan	(2/20) x 100% = 10.00%
Pompa susu	(1/20) x 100% = 5.00%
Pelindung puting susu	(3/20) x 100% = 15.00%
Botol susu	(2/20) x 100% = 10.00%
Alat tes kehamilan	(1/20) x 100% = 5.00%
Alat suntik	(1/20) x 100% = 5.00%
Kompres dingin	(1/20) x 100% = 5.00%
Tensimeter	(1/20) x 100% = 5.00%
Penyangga leher	(3/20) x 100% = 15.00%

The results of the formation of C3 or referred to as 3 and 4 itemsets with a minimum amount of support = 30% with the following formula:

Table 7. 3 dan 4 Item Support

Data Transaksi	Support
Termometer	(14/20) x 100% = 70.00%
Kain kasa	(16/20) x 100% = 80.00%
Plaster	(11/20) x 100% = 55.00%
Perban elastis	(6/20) x 100% = 30.00%

The process of forming C3 or what is called 3 and 4 itemsets with a minimum amount of support = 30% with the following formula:

Table 8.
3 item Aturan Asosiasi

Nama Item	Jumlah	Confident
Termometer, Kain Kasa, Plaster	6	(6/11) x 100 = 54 %

Table 9.
4 item Aturan Asosiasi

Nama Item	Jumlah	Confident
Termometer, Kain Kasa, Plaster, Perban elastis	4	(4/6) x 100 = 66 %

The combination of 3 and 4 itemset can meet a minimum support of 30%, then the next step is the formation of associations. After all high frequency patterns are found, then look for the association rule that satisfies the confidence by calculating the associative confidence rule A-B.

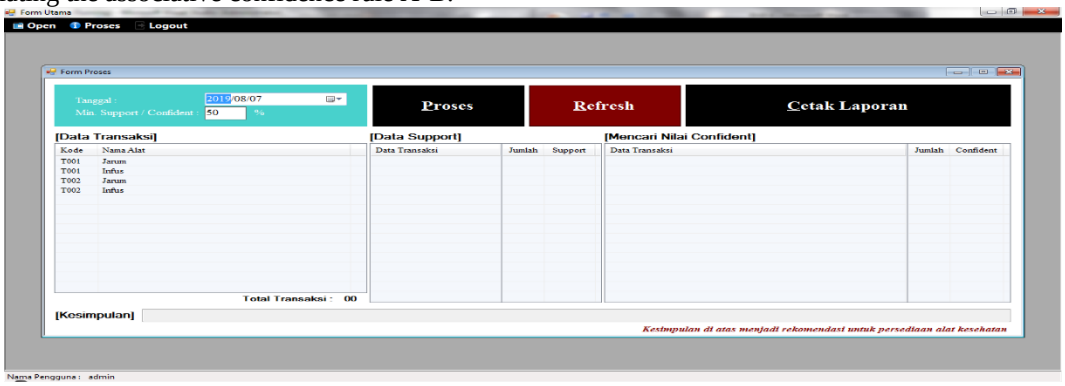

Figure 2. Result Method Apriori

The results of the pattern analysis above show that the greater the value of support from a combination of medical devices provides recommendations for medical devices that are most often purchased by consumers, namely thermometers, gauze, plaster, and elastic bandages. Conversely, the smaller the value of support for a combination of medical devices means that recommendations are given based on medical devices that are rarely purchased. By using the resulting pattern it can be used as a recommendation by the party to determine the supply of medical devices.

4. Conclusions

From the Apriori analysis research in Medical Device Supply Planning at Pharmacies, the conclusions can be obtained as follows:

1. The results of the pattern analysis above show that the greater the value of support from a combination of medical devices provides recommendations for the most frequently purchased medical devices by consumers, namely thermometers, gauze, plaster, and elastic bandages. Conversely, the smaller the value of support for a combination of medical devices means that recommendations are given based on medical devices that are rarely purchased.
2. The results of applying the a priori method with a minimum support of 30% with a combination of 3 and 4 itemsets are if the thermometer, gauze, plaster, elastic bandages.
3. The priori method used is quite effective in providing the final result of the drug combination that is often purchased by consumers. The level of accuracy of the test using the a priori method is 100%.

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